

**"THE EFFECT OF CODUSE GROUP EXERCISE IMPROVES
BALANCE AND REDUCE FALLS IN PATIENTS WITH
MULTIPLE SCLEROSIS - A COMPARATIVE STUDY."**

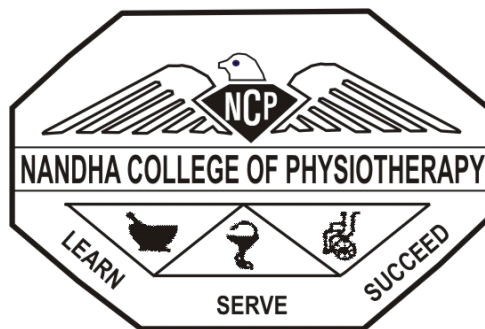
A Dissertation Submitted To
**THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY
CHENNAI**

In partial fulfillment of the requirements for the awards of the

**MASTER OF THE PHYSIOTHERAPY
(PHYSIOTHERAPY IN NEUROLOGY)**

Submitted by

Reg. No. 271720061



NANDHA COLLEGE OF PHYSIOTHERAPY

ERODE – 638052

MAY- 2019

THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY
NANDHA COLLEGE OF PHYSIOTHERAPY
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The dissertation entitled

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Under the guidance of

Prof.V.VIJAYARAJ M.P.T(Neuro).,M(Acu).,DVMS., MIAP.,

The Dissertation Submitted To

**THE TAMILNADU DR. M.G.R MEDICAL UNIVERSITY,
CHENNAI**

Dissertation evaluated on

INTERNAL EXAMINER

EXTERNAL EXAMINER

CERTIFICATE BY THE HEAD OF THE INSTITUTION

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This is to certify that **Reg. No : 271720061** is a bonafide student of **Nandha College of Physiotherapy**, studying **MASTER OF PHYSIOTHERAPY (PHYSIOTHERAPHY IN NEUROLOGY)** degree course from the year 2017-2019. This dissertation entitled **“THE EFFECT OF CODUSE GROUP EXERCISE IMPROVES BALANCE AND REDUCE FALLS IN PATIENTS WITH MULTIPLE SCLEROSIS - A COMPARATIVE STUDY.”**

is a record to original and independent work guided and supervised by **Prof.V.VIJAYARAJ M.P.T(Neuro),M(Acu),DVMS., MIAP.,**

I wish him a great success in his dissertation work.

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“THE EFFECT OF CODUSE GROUP EXERCISE IMPROVES BALANCE AND REDUCE FALLS IN PATIENTS WITH MULTIPLE SCLEROSIS - A COMPARATIVE STUDY.” is a bonafide compiled work, carried out by Reg.No. **271720061, Nandha College of Physiotherapy,Erode-638 052** in partial fulfilment for the award of graduate degree in Master of Physiotherapy (Physiotherapy Neurology) as per the doctrines of requirements for the degree from **THE TAMILNADU Dr.M.G.R.MEDICAL UNIVERSITY, Chennai**. The dissertation represents entirely an independent work on the part of the candidate but for the general guidance by me.

Place : Erode

Guide Signature

Date :

DECLARATION

I hereby and present my project work entitled **“THE EFFECT OF CODUSE GROUP EXERCISE IMPROVES BALANCE AND REDUCE FALLS IN PATIENTS WITH MULTIPLE SCLEROSIS - A COMPARATIVE STUDY.”** is outcome of original research work was undertaken and carried out by me under the guidance of **Prof.V.VIJAYARAJ M.P.T(Neuro),M(Acu),DVMS., MIAP.,**

To the best of my knowledge this dissertation has not been formed in any other basic for the award of any other degree, diploma, associateship, fellowship, preciously from any other medical university.

Reg. No. 271720061

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I am very happy to express my heartfelt thanks to the **GOD** almighty giving me strength and wisdom in successfully completing this project work in an efficient manner.

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I also have much gratitude to **my FRIENDS** for their known interest and in my academic excellence.

Last but not the least, I would like to pay my gratitude to **My Parents & Sister** who always had so much confidence in me and always provided me with a constant silent support, encouragement and inspiration.

PREFACE

It was immense pleasure for me to present this project work on **“THE EFFECT OF CODUSE GROUP EXERCISE IMPROVES BALANCE AND REDUCE FALLS IN PATIENTS WITH MULTIPLE SCLEROSIS - A COMPARATIVE STUDY”**. Because this opportunity made me learn a lot about this condition.

I have done this work with my best level by referring many Neurological books, journals and websites. I have assessed and given treatment to patient to improve their condition. I believe this project work will prove to be very useful for the physiotherapists to give a better knowledge while assessing and treating Multiple sclerosis patients.

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CHAPTER - I

“INTRODUCTION”

CHAPTER – 1

1.1-INTRODUCTION

Impaired balance and trunk control and difficulty to perform trunk control and difficulty to perform dual tasks are common in people with multiple sclerosis. Balance functions can improve by specific exercise thus possibly reducing falls. Multiple sclerosis (MS) is a demyelinating disease in which the insulating covers of nerve cells in the brain and spinal cord are damaged. This damage disrupts the ability of parts of the nervous system to communicate, resulting in a range of signs and symptoms, including physical, mental, and sometimes psychiatric problems. Specific symptoms can include double vision, blindness in one eye, muscle weakness, trouble with sensation, or trouble with coordination. MS takes several forms, with new symptoms either occurring in isolated attacks (relapsing forms) or building up over time (progressive forms). Between attacks, symptoms may disappear completely; however, permanent neurological problems often remain, especially as the disease advances. Balance function can improve by specific exercise, thus possibly reducing falls. Freeman.etal reported a study in which eight week core stability exercise programmed balance and mobility skills. Another study compared core stability exercises to standard exercise and relaxation sessions in a randomized controlled trial including 100 MS patients. The study revealed that the programme did not improve walking capacity or perceived balance confidence.

1.2) DEFINITION

Multiple sclerosis (MS) is a demyelinating disease in which the insulating covers of nerve cells in the brain and spinal cord are damaged. This damage disrupts the ability of parts of the nervous system to communicate, resulting in a range of signs and symptoms, including physical, mental, and sometimes psychiatric problems.

1.3) ETIOLOGY

- **Age.** MS can occur at any age, but most commonly affects people between the ages of 15 and 60.
- **Sex.** Women are about twice as likely as men are to develop MS.
- **Family history.** If one of your parents or siblings has had MS, you are at higher risk of developing the disease.
- **Certain infections.** A variety of viruses have been linked to MS, including Epstein-Barr, the virus that causes infectious mononucleosis.
- **Race.** White people, particularly those of Northern European descent, are at highest risk of developing MS. People of Asian, African or Native American descent have the lowest risk.
- **Climate.** MS is far more common in countries with temperate climates, including Canada, the northern United States, New Zealand, southeastern Australia and Europe.
- **Certain autoimmune diseases.** You have a slightly higher risk of developing MS if you have thyroid disease, type 1 diabetes or inflammatory bowel disease.
- **Smoking.** Smokers who experience an initial event of symptoms that may signal MS are more likely than nonsmokers to develop a second event that confirms relapsing-remitting MS.
- Genetics

1.4) NEED FOR THE STUDY

This study is intended to improve balance and reduce falls in subjects with multiple sclerosis.

1.5) AIM OF THE STUDY:

This is to compare conventional physiotherapy treatments with CoDuSe group exercise program for improving balance and reduce falls in subjects with multiple sclerosis.

1.6) OBJECTIVE OF THE STUDY

The objective of the study is to find the effectiveness of conventional physiotherapy treatments with CoDuSe group exercise program for improving balance and reduce falls in subjects with multiple sclerosis.

1.7 VARIABLES OF THE STUDY

1.7A) DEPENDABLE VARIABLES

BBS

TUG SCALE

1.7B) INDEPENDENT VARIABLES

1. CoDuSe Group Exercise Program
2. Conventional Physiotherapy Techniques

1.8) OPERATIONAL DEFINITION

MULTIPLE SCLEROSIS

Multiple sclerosis (MS) is a potentially disabling disease of the brain and spinal cord (central nervous system).

- **ROCHESTER(2014)**

CODUSE

Exercise concepts on core stability in combination with dual task and sensiomotor challenges

- **Nilsagard(2003)**

BBS

The Berg balance scale is used to objectively determine a patient's ability (or inability) to safely balance during a series of predetermined tasks.

- **Berg K,(1992)**

TUG

The Timed Up and Go test (TUG) is a simple test used to assess a person's mobility and requires both static and dynamic balance.

- **Richardson(1991)**

1.9) HYPOTHESIS

1.9(A) NULL HYPOTHESIS

There is no significant difference in conventional physiotherapy treatments with CoDuSe group exercise program for improving balance and reduce falls in subjects with multiple sclerosis.

1.9(B)ALTERNATE HYPOTHESIS

There is significant difference in conventional physiotherapy treatments with CoDuSe group exercise program for improving balance and reduce falls in subjects with multiple sclerosis.

CHAPTER - II

“REVIEW OF LITERATURE”

CHAPTER -2

REVIEW OF LITERATURE

ANNA CARLIN ET AL (2016)

The purpose of the study is to evaluate the effects of a balance group exercise programme (CoDuSe) on balance and walking in PwMS .

ELA TARAKCI . ET AL (2013)

To determine the effectiveness of group exercise training on balance, functional status, spasticity, fatigue and quality of life in patients with multiple sclerosis.

SINIKKA.H. ET AL (2012)

The purpose of the study is to determine the effects of physiotherapy interventions on balance in people with multiple sclerosis.

U DALGAS. ET AL (2011)

The purpose of the study is to determine the effect of exercise therapy on MS fatigue by systematically reviewing the literature.

JACOB J. ET AL (2011)

The purpose of the present study was to assess the relation between demographic, clinical, mobility and balance metrics and falls history in persons with multiple sclerosis (MS).

Knorr S. ET AL (2010)

The purpose of the present study was to examine the convergent validity, sensitivity to change, floor and ceiling effects of the Community Balance and Mobility Scale (CB&M) in community-dwelling stroke survivors.

PAULA KERSTEN. ET AL (2010)

The purpose of the present study was to examine the internal validity of the static sitting balance, dynamic sitting balance, and coordination subscales of the Trunk Impairment Scale (TIS), a reliable and valid scale measuring trunk performance and sitting balance in people after stroke.

LUCA PROSPIRINI. ET AL (2010)

The purpose of this study was to evaluate the effectiveness of a home-based rehabilitation of balance using the Nintendo Wii Balance Board System (WBBS) in patients affected by multiple sclerosis (MS).

JA FREE MAN. ET AL (2010)

To explore the effectiveness of core stability training on balance and mobility.— Resistance exercise via negative, eccentrically induced work (RENEW) has been shown to be associated with improvements in strength, mobility, and balance in multiple clinical populations. However, RENEW has not been reported for individuals with multiple sclerosis (MS)..

CAKIT . ET AL (2010)

The purpose of this study was to evaluate the effects of cycling progressive resistance training combined with balance exercises on walking speed, balance, fatigue, fear of falling, depression, and quality of life in patients with multiple sclera.

ROBERT W. ET AL (2008)

The purpose of the study is to examine the overall effect of exercise training interventions on walking mobility among individuals with multiple sclerosis.

ALFREDO CHETTA. ET AL (2007)

The purpose of this study was to compare the effects of an 8-week AT program on exercise capacity - in terms of walking capacity and maximum exercise tolerance, as well as rehabilitation (NR) in subjects with MS.

BARBARA GIESSER. ET AL (2007)

The purpose of this protocol was to investigate the potential benefits and tolerability of locomotor training using body weight support on a treadmill (LTBWST) in persons with multiple sclerosis (MS).

LARA A. ET AL (2007)

The purpose of this study was to examine the effects of body-weight supported treadmill training (BWSTT) on functional ability and quality of life in patients with progressive multiple sclerosis (MS) of high disability.

DR NF TAYLOR. ET AL (2005)

The purpose of the study is to determine if participation in a progressive resistance exercise (PRE) programme can: (1) increase the ability to generate maximal muscle force, (2) increase muscle endurance, (3) increase functional activity, and (4) improve overall psychological function of people with multiple sclerosis (MS).

L J WHITE (2004). ET AL

The purpose of this study was to evaluate the effect of an eight-week progressive resistance training programme on lower extremity strength, ambulatory function, fatigue and self-reported disability in multiple sclerosis (MS) patients.

GREGORY M. ET AL (2004)

The purpose of this study was to evaluate the effects of an 8-week lower-body resistance-training program on walking mechanics in persons with multiple sclerosis (MS).

BRAZ J . ET AL (2004)

The purpose of the present study was to translate and adapt the Berg balance scale, an instrument for functional balance assessment, to Brazilian-Portuguese and to determine the reliability of scores obtained with the Brazilian adaptation.

WHITNEY. ET AL (2003)

Content validity of the BBS was established in a 3-phase development process involving 32 health care professionals who were experts working in geriatric settings. Criterion-related validity has been supported by moderate to high correlations between BBS scores and other functional measurements in a variety of older adults with disability.

WILES. ET AL (CM 2001)

The purpose of the study is to determine whether physiotherapy can improve mobility in chronic multiple sclerosis and whether there is a difference between treatment at home and as a hospital outpatient.

SE LORD. ET AL (1988)

The purpose of the study is to compare two physiotherapy approaches to improve walking in patients with gait disturbance due to multiple sclerosis (MS).

FRANCO PAOLO ET AL (1997)

The purpose of the study is to find out the validity of BBS in evaluating balance in MS patients.

CHAPTER - III

*“MATERIALS AND
METHODOLOGY”*

CHAPTER-3

MATERIALS AND METHODOLOGY

3.1) MATERIALS:

- A ruler
- 2 standard chairs (one with arm rests, one without)
- A footstool or step
- 15 ft walkway
- Stopwatch or wristwatch
- Tape
- Recording sheet
- Pen/pencil
- Couch/mats
- Wobble board
- Therabands/thera tubes
- Cones, obstacles and peg board

3.2) METHODOLOGY

3.2.1) STUDY DESIGN:

Pre and Post test Experimental Study

3.2.2) STUDY SETTING

- Kims Hospital, Trivandrum
- Senthil Neuro Speciality Hospital, Erode
- NIMHANS Hospital , Bangalore
- Out Patient Department , Nandha College Of Physiotherapy

3.2.3) SAMPLE SIZE:

30 patients with multiple sclerosis were selected who met with the inclusion criteria.

Group- 15 patients – conventional physiotherapy techniques

Group b- 15 patients – CoDuSo group exercise program

3.2.4) SAMPLE TECHNIQUE:

Convenient sample method.

3.2.5) STUDY POPULATION

The study population selected was 30 patients with multiple sclerosis.

Age: 15-60years

Sex: Both GENDERS

3.2.6) STUDY DURATION

The total duration of study is 9 months.

3.2.7) TREATMENT DURATION:

The treatment duration is 60minutes

3.3) CRITERIA FOR SELECTION

3.3A) INCLUSION CRITERIA:

- Multiple sclerosis diagnosed according to the Mc Donald criteria.
- Walking ability not exceeding 200m.
- Ability to transfer between a wheel chair and a plinth with only slight assistance
- Subject aged 16 years and above

3.3B) EXCLUSION CRITERIA:

- Cognitive symptoms making it difficult to understand the study information, or follow the instructions.follow .
- Having medical care related to impaired walking during the past 3 months.
- Having participated in the balance exercise administered by the health care personel for the past 30 days
- Having started or changed medication with 4-aminopyridine during the past 30 days
- Subject aged below 16 and above 60years of age
- History of any recent trauma or fracture
- Osteoporosis

3.4) PARAMETERS

- BBS [BERG BALANCE SCALE]
- TUG SCALE [TIME UP AND GO SCALE]

GENERAL INSTRUCTION

“Today we are going to take a look at how you are able to improve balance. Let me tell you how we are going to go about this. First, I will give you instructions on how to do the task, and then I will show you how to do it. I will describe and demonstrate each task 2 times. Do not practice the task while I’m describing and demonstrating it. However, I will be happy to clarify any confusing points. Then I will say “Ready, set, go” and you will do the task.”

It is important that you do not start until I say “go” otherwise, we will need to repeat the entire task. Each of the activities you will be asked to do should be carried out as rapidly as possible. You can work on each task for up to two minutes. We ask that you attempt each part of the test even if you do not think that you can do it. If you are unable to carry out a task, then we will go on to the next one. Again, try to do each task as rapidly as possible.

3.5PROCEDURE:

- Subjects were selected by convenient sampling method. 30 subjects who fulfilled inclusion criteria and exclusion criteria were selected by random sampling method, out of them 15 were allotted in Group A and 15 in Group B.
- Subjects were clearly explained about the study about written informed consent was obtained from the subjects who fulfilled the criteria.
- After completing the informed consent and they were explained about the scales and the scales were administered.
- Proper instructions such as purpose, safety measures, comfort , precautions and psychological support were given to the subjects.
- All vitals were checked
- While doing the assessment , the subjects willingness to continue the procedure with or without rest was given preference. Both group A and B subjects were involved for pre test assessment. Group a underwent CoDuSe group exercise program, Group B underwent conventional physiotherapy techniques were performed for 60 minutes, 2 days per week for 7 weeks. The total duration is 60 minutes.

GROUP A:

- The subjects in the group A receives CoDuSe balance exercise including core stability exercise, dual tasking and sensory strategies.
- The first 30 minutes were primarily focused on core stability exercises that is controlled leg movements.
- The participants were then encouraged to maintain focus on core stability while performing the remaining exercises, which include dual tasking and sensory strategies such as carrying something while walking or walking in an uneven surface.
- The participants perform exercises such as pelvic bridging, prone on elbow, single leg bridging etc.
- The participants performed dual task training by performing walking by controlled leg movements and by walking with carrying an object in an uneven surface.
- The participants performs sensory tasks like clay modelling, walking in irregular surfaces like walking over pebble stones, sands etc
- The participants were encouraged and instructed by the therapist to progress to more challenging exercises when suitable.
- In addition subjects were given individually tailored home exercise programme with two or five exercises.
- Progression of the exercises was continuously adjusted by the therapist.



Fig(3.1) shows dual task training.



Figure(3.2) shows core strengthening

GROUP-B

The subjects in the group b receives conventional physiotherapy exercises as follows for a session of 60 minutes.

- Strengthening exercises.
- Stretching exercises.
- Gait training.
- Balance and coordination exercises.
- Obstacle training.
- Subjects were only concentrated in physical exercises.



Figure shows conventional exercise therapy

CHAPTER - IV

*“DATA PRESENTATION AND
STATISTICAL ANALYSIS”*

CHAPTER – 4

DATA ANALYSIS AND PRESENTATION

4.1 STATISTICAL TOOLS

For the pre and post test experimental study, both paired and unpaired 't' test was used for each parameter in an intra group analysis to find out the significance of improvement achieved through intervention. Then unpaired 't' test was used to find out the significance of the changes between two groups i.e., inter-group analysis.

4.1A) PAIRED 't'-TEST

To compare the effect between two groups 't' test for paired values.

Formula for paired t-test

$$S = \frac{\sum d^2 - \frac{(\sum d)^2}{n}}{n-1}$$

$$t = \frac{\bar{d}\sqrt{n}}{s}$$

\bar{d} = Mean difference

n = Total number of subjects

S = Standard deviation

d = difference between the pre test and post test

4.1B) UNPAIRED t-TEST

The unpaired t-test was used to compare the effects between two groups, 't' test for unpaired values

Formula unpaired t-test

$$S = \sqrt{\frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1+n_2-2}}$$

$$t = \frac{|\bar{x}_1 - \bar{x}_2|}{s \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

n_1	=	Total number of subjects in Group A.
n_2	=	Total number of subjects in Group B.
\overline{X}_1	=	Mean difference between pre test and post test of Experimental Group A.
\overline{X}_2	=	Mean difference between pre test and post test of Control Group A.
S_1	=	Difference between pre test and post test of Experimental Group B.
S_2	=	Difference between pre test and post test of Control Group B.

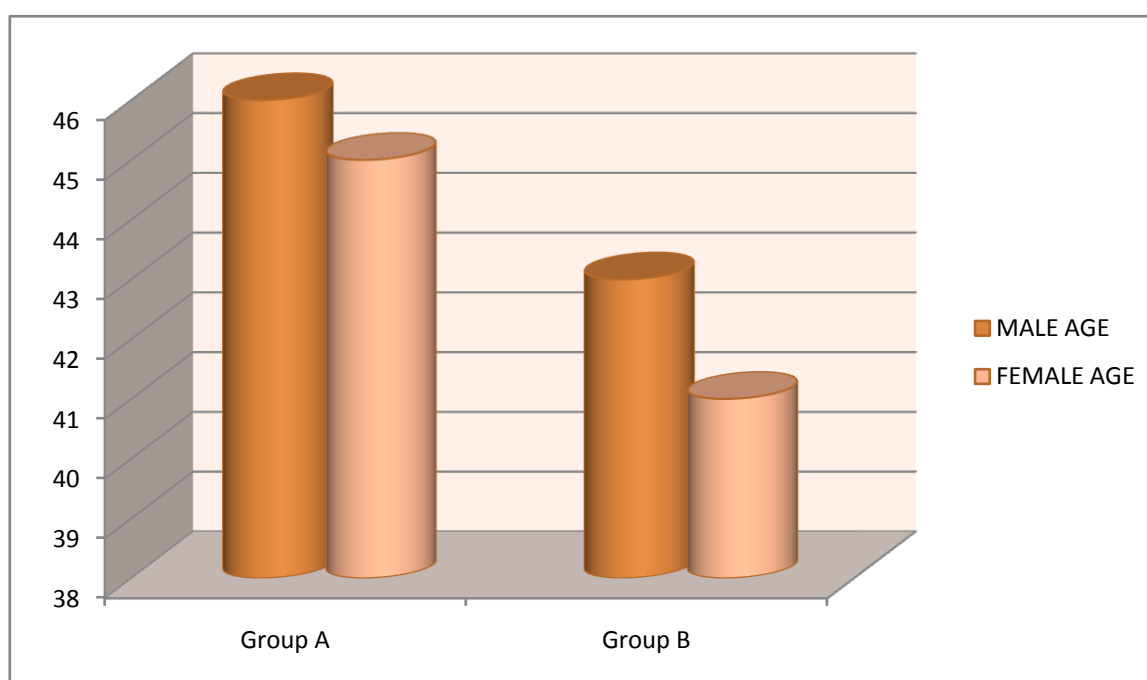
TABLE-4.2

MEAN AVERAGE AGE GROUP OF GROUP A AND GROUP B

Mean Age Group	Group A	Group B
male's	46	43
female's	45	41

Table 4.2 and figure 4.2 shows the information relating to the age group among the patients in the study.

FIG-4.2 THE MEAN AVERAGE AGE OF GROUP A AND GROUP B



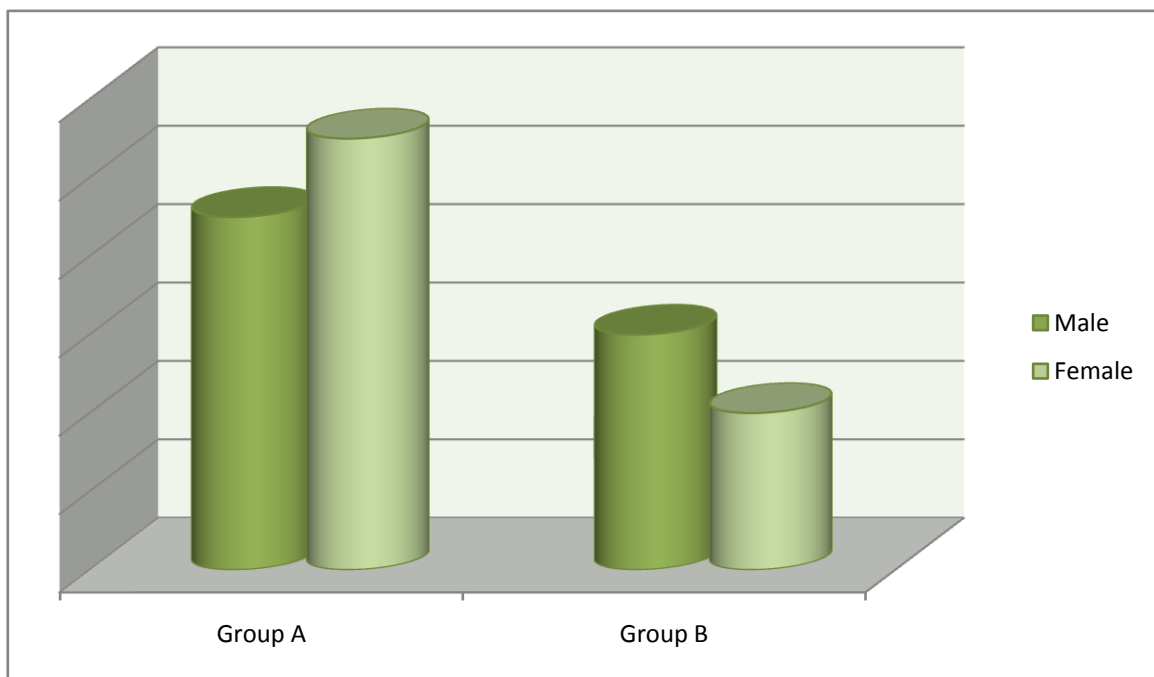
SEX DISTRIBUTION OF GROUP A AND GROUP B

Table 4.3 and Figure 4.3 shows the sex distribution among the study. There are 60% of males and 40% of females in both Groups.

TABLE-4.3

Sex Distribution	Group A	Group B
male's	9	11
female's	6	4

FIG 4.3 SEX DISTRIBUTION OF GROUP A AND GROUP B



MEAN DIFFERENCE BETWEEN GROUP A AND GROUP B OF BBS AND TUG

Table 4.4 shows mean difference between Group A and Group B of BBS and TUG .

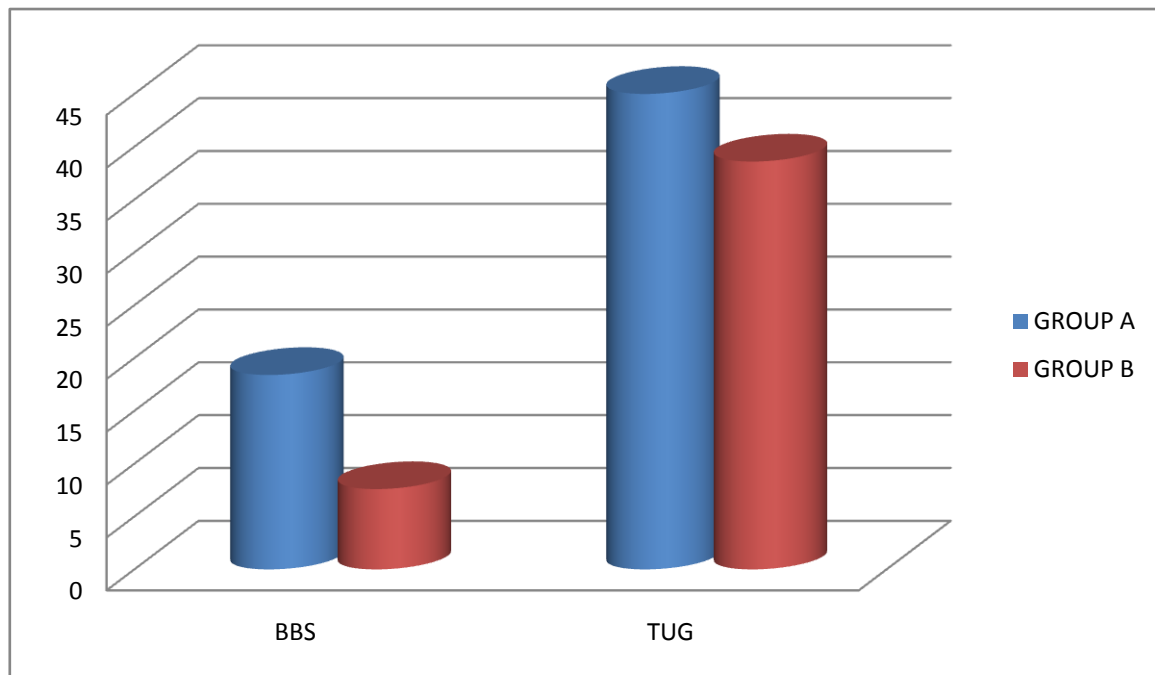
TABLE-4.4

GROUPS	MEAN DIFFERENCE	
	BBS	TUG
GROUP-A	18.4	45
GROUP-B	7.6	38.6

Mean difference of BBS for Group A and B is 18.4 & 7.6 respectively

Mean difference of TUG for Group A and B is 45 & 38.6 respectively

FIGURE-4.4 (MEAN DIFFERENCE OF BBS AND TUG SCALE)



STANDARD DEVIATION BETWEEN GROUP A AND GROUP B OF BBS AND TUG SCALES

TABLE 4.5 SHOWS STANDARD DEVIATION BETWEEN GROUP A AND
GROUP B OF BBS AND TUG SCALES

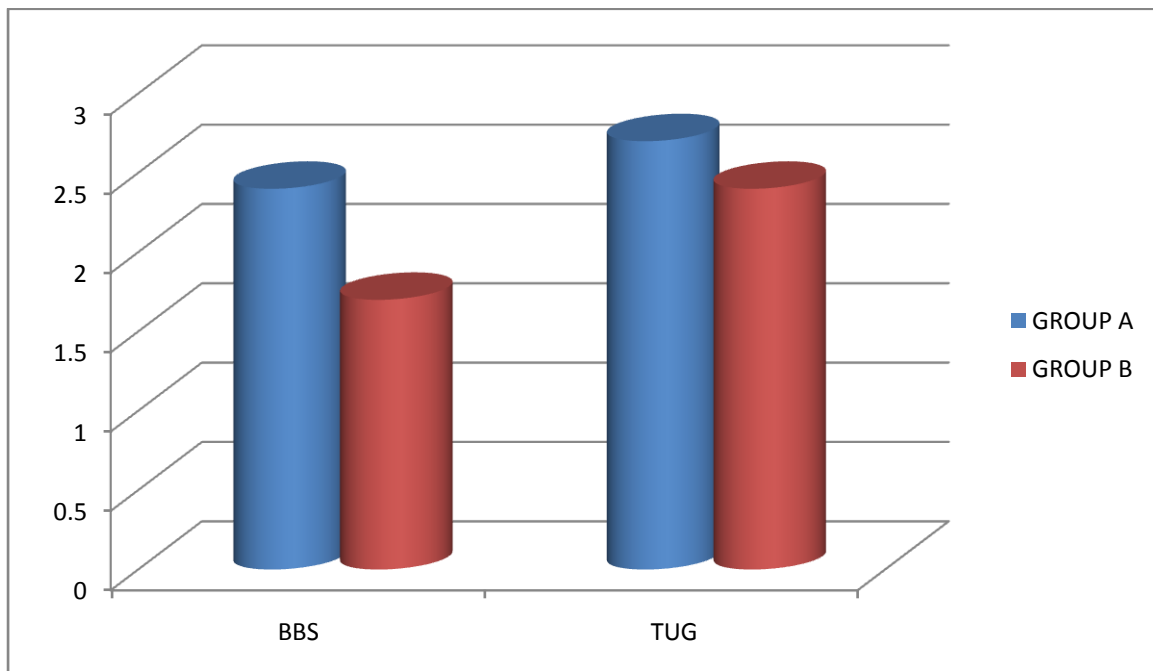
TABLE-4.5

GROUPS	STANDARD DEVIATION	
	BBS	TUG
GROUP A	2.4	2.7
GROUP B	1.7	2.4

Group A standard deviation value is 2.4 and 2.7 respectively.

Group B standard deviation value is 1.7 and 2.4 respectively.

FIGURE-4.5 (STANDARD DEVIATION OF BBS AND TUG SCALES)



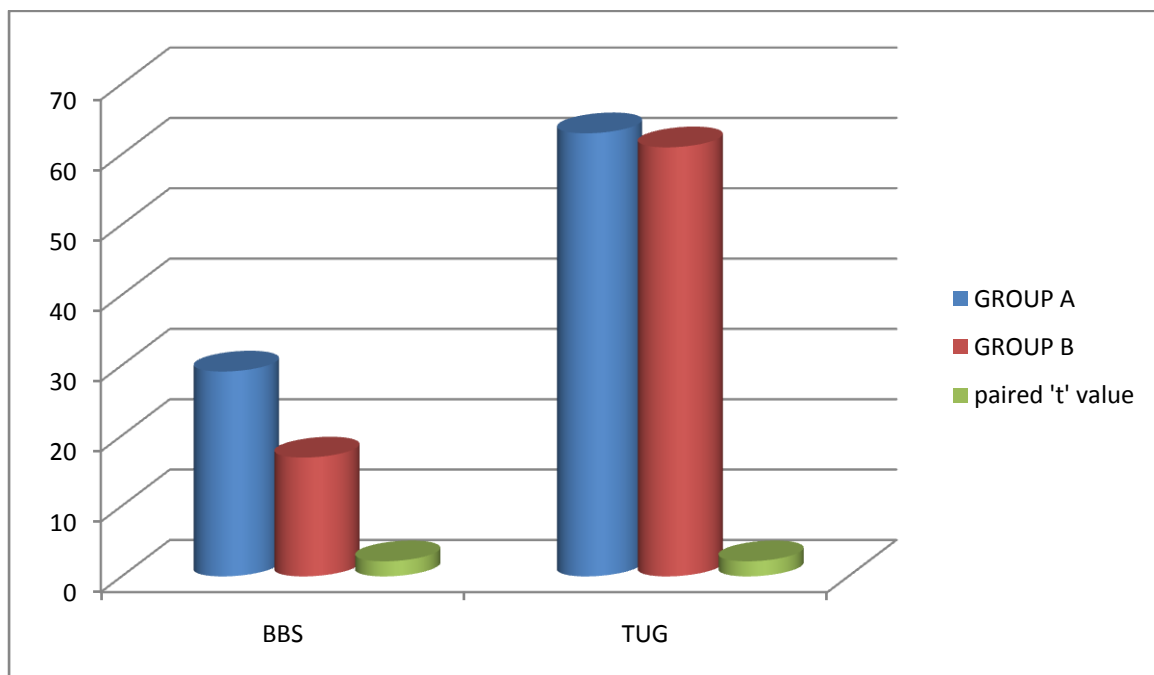
**COMPARISION OF THE PAIRED 't' TEST AND TABLE VALUE BETWEEN
GROUP A AND GROUP B**

TABLE-4.6

GROUPS	CALCULATED 't' VALUE		TABLE VALUE	SIGNIFICANCE
	BBS	TUG		
GROUP A	29.13	63	2.15	SIGNIFICANT
GROUP B	16.9	61	2.15	SIGNIFICANT

For 9 degree of freedom and at 5%level of significance, the table value is 2.15 and the calculated group A t value is 29.13 and 63, the group B t value is 16.9 and 61 since the calculated t values was greater than the table t value, null hypothesis is rejected.

FIGURE-4.6 (PAIRED 't' TEST AND TABLE VALUE OF BBS AND TUG SCALES)

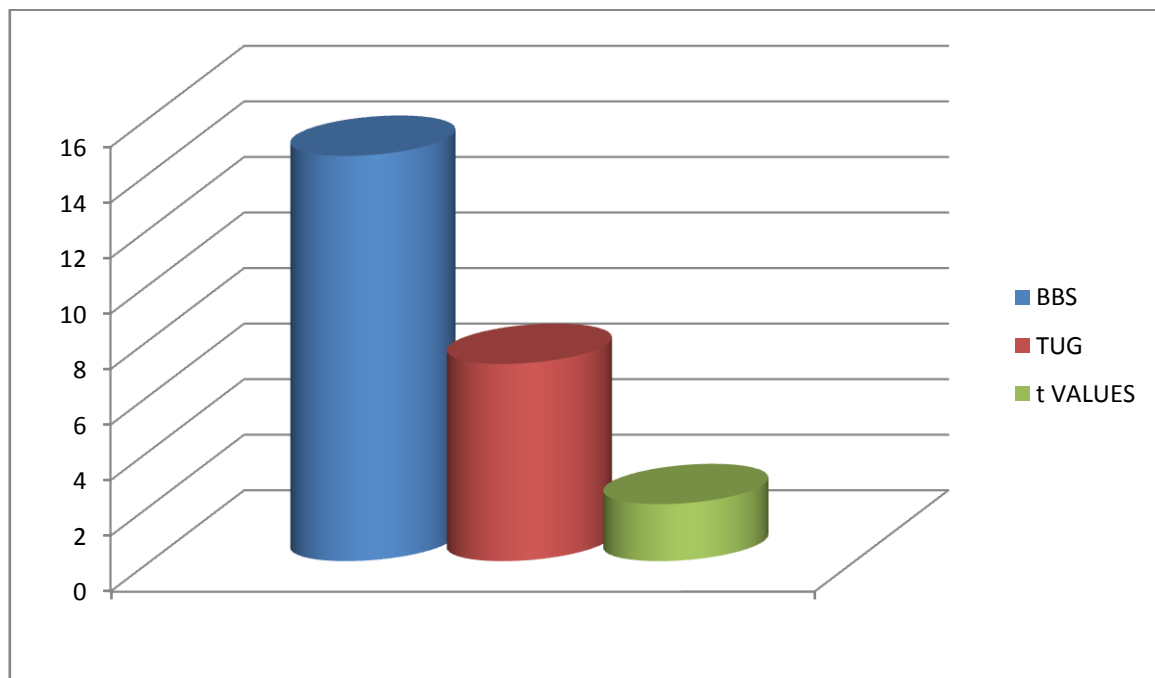


**COMPARISION OF UNPAIRED 't' TEST AND TABLE VALUE BETWEEN
BBS AND TUG
TABLE-4.7**

GROUP	UNPAIRED 't' TEST		TABLE VALUE	SIGNIFICANT
GROUP A & GROUP B	BBS	TUG	2.05	SIGNIFICANT
	14.59	7.1		

For 9 degree of freedom and at 5% level of significance, the table values is 2.05 and the calculated BBS unpaired t value is 14.59 and the TUG unpaired t value is 7.1 since the calculated unpaired t value was greater than the table t value, null hypothesis is rejected.

FIGURE -4.6 (UNPAIRED 't' TEST AND TABLE VALUE OF BBS AND TUG)



CHAPTER - V

“RESULTS AND
DISCUSSION”

CHAPTER - 5

RESULTS AND DISCUSSION

5.1RESULTS

The study sample comprised 30 patients ,of which 20 were male and 10 were female patients with multiple sclerosis disease. Among 30 patients 15 were treated with C and other 15 patients were treated with conventional therapy . The pre and post test values were assessed by berg balance scale and mini mental state examination scale in group A . The mean difference value of BBS is 18., .TUG is 45 respectively. The standard deviation of BBS is 2.4, TUG is 2.7 the paired t-test value for BBS is 29.13, TUG is 63 respectively. The paired t-test value is more than the table value 2.15 or 5% level of significance at 14degrees of freedom.

The pre and post test value were assessed by BBS and TUG in group B. the mean difference value of BBS 7.6, TUG is 38.6 respectively. The standard deviation of BBS 1.7,TUG is 2.4 respectively. The t- test for BBS is 16.9 , TUG is 61 respectively. The paired t-test value is more than the table value 2.15 or 5% level of significance at 14 degree of freedom.

The calculated t value by unpaired t test for group A and B were 14.59 for BBS, TUG is 7.1 . The calculated t value were more than the table value 2.05 for 5% level of significance at 28 degrees of freedom.

5.2 DISCUSSIONS

The study sample comprised 30 patients of both gender. The mean age of patient was 50 years. The groups differed at baseline in terms of age , sex and MS subtypes. This study suggests that the CoDuSe balance group exercise programme improves balance, as BBS and TUG scale and perceived limitation in walking due to MS as compared to the conventional physiotherapy treatments.. it also reduces the number of falls as well as near falls. These discussions are in line with those presented in previous study and imply that CoDuSe intervention is a promising intervention in disease stages characterized by significant loss of walking ability. This result is in line with that reported after twelve 30-minutes exercise sessions during 12 weeks of pilates group study exercise , enhanced with individualized daily home exercise home exercise programme.

The CoDuSe intervention led to a reduction of falls which is important , as falls can lead to injury and activity curtailments. The ability to reproduce these results in a new sample strengthens that the intervention is effective to reduce risk of falls atleast in a shorter time period. The number of prospectively reported that near falls also reduced. Being able to manage imbalance without falling can be seen as a successful strategy. The participants also learnt to maintain stability in situations where they had lost balance.

This study proved that CoDuSe group exercise program improves balance and reduce risk of falls in people with Multiple Sclerosis.

CHAPTER - VI

“SUMMARY AND
CONCLUSION”

CHAPTER -6

LIMITATION AND SUGGESTION

6.1. LIMITATIONS

- This study has been conducted on small sized sample only.
- This study has taken more time to complete.
- Variation in calamite, drugs, diet, personal habit, side of involvement, gender, age could not be controlled.
- Lack of pre-intervention data on falls and near falls
- Heterogeneity is difficult to forestay in samples of MS and study may be under powered
- The intention of the MS care is to encourage people to be as active as possible.

6.2 SUGGESTION

- A similar study may be extended with larger samples.
- A similar study may be extended to conservatively treated patients.

CHAPTER - VI

“SUMMARY AND
CONCLUSION”

CHAPTER -7

SUMMARY AND CONCLUSION

The multiple sclerosis is one of the most important neuromuscular disease. About two third of the population experiences this disease. Impaired balance and trunk control and difficulty to perform dual tasks are common with multiple sclerosis patients. Due to imbalance and trunk instability many people are under risk of fall. The CoDuSe intervention led to a reduction of falls which is important , as falls can lead to injury and activity curtailments. The ability to reproduce these results in a new sample strengthens that the intervention is effective to reduce risk of falls at least in a shorter time period.

The multiple sclerosis is one of the most common neuromuscular disease. About one third of the population is affected with multiple sclerosis. Through the results, **NULL HYPOTHESIS IS REJECTED AND ALTERNATE HYPOTHESIS IS ACCEPTED** and also the study could be concluded that **THERE IS A SIGNIFICANT DIFFERENCE BETWEEN “CODUSE GROUP EXERCISE PROGRAM AND CONVENTIONAL PHYSIOTHERAPY EXERCISES IN IMPROVING BALANCE AND REDUCE RISK OF FALLS IN PATIENTS WITH MULTIPLE SCLEROSIS”**

“BIBLIOGRAPHY”

BIBLIOGRAPHY

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PHYSICAL REHABILITATION-SUSAN B O SULLIVAN

WEBSITE

WWW.PHYSIPEDIA.COM
EMEDICINE.MEDSCAPE.COM
WWW.MYOCLINIC.ORG
WWW.MEDICINENET.COM
WWW.WIKIPEDIA.COM
WWW.NCBI.COM

APPENDIX-1

ETHICAL CLEARANCE

Ethically permissions for the study will be obtained from the subjects and a written consent form will be taken from each subjects who participates in this study.As this study involve human subjects the ethical clearance has been obtained from the ethical committee of Nandha College of Physiotherapy,Erode as per the ethical guidelines for Bio-medical research n human subjects.2000 ICMR(Indian Council Of Medical Research) New Delhi.

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APPENDIX-2

Written Informed Consent Form

NANDHA COLLEGE OF PHYSIOTHERAPY ERODE.

Informed consent form for the volume at Nandha College Of Physiotherapy, Erode who will be participating in the research project entitled, **“EFFECTIVENESS OF CODUSE GROUP EXERCISE PROGRAM AND CONVENTIONAL PHYSIOTHERAPY EXERCISE IN IMPROVING BALANCE AND REDUCE RISK OF FALLS IN PATIENTS WITH MULTIPLE SCLEROSIS- A COMPARATIVE STUDY”**

Name of the principal investigation	271720061
Name of the Organization	Nandha College Of Physiotherapy Erode

This informed consent form has two parts:

- **Information sheet(to share the information about the research to you)**
- **Certificate of consent(for signature if you agree to take part)**

You will be given a copy of the full informed consent form

PART:1 INFORMATION SHEET

INTRODUCTION:

I postgraduate student in the Department of Physiotherapy, Nandha college of physiotherapy, Erode, I am working on my dissertation titled **“CoDuSe group excise programme improves balance and reduces falls in people with multiple sclerosis - A comparative study”**.

I am going to give you information and invite you to be part of this research. You do not have to decide today whether or not you will participate in the research. Before you decide. You can talk to anyone you feel comfortable with about the research

There may be some words that you do not understand. Please ask me to stop as we go through the information and I will take time to explain. If you have questions later, you can ask them and get yourself clarified.

Purpose of research

To find out the effectiveness in CoDuse group excise program.

Type of research intervention

In this study if you are selected detailed history taking examination and routine investigation will be done

Participant selection

Study group: adult between age 16-65 years

Possible Risk

There are no major physical risks for the person associated with these methods. Complications include exacerbation of symptoms after treatment which is rare possibility.

Reimbursement

You won't be given monetary incentives or gifts for being a part of this research.

Confidentiality

The information that we collect from this research project will be kept confidential. Information about the patient that will be collected during the research will be put away and no-one but the researchers will be able to see it.

Right to Refuse or withdraw

You do not have to take part in this research if you do not wish to do so. You may also stop participating in the research at any time you choose. It is your choice and all of your rights will still be respected.

Who To Contact

This proposal has been reviewed and approved by the Research and Ethical committee of Nandha College of Physiotherapy, Erode, which is a committee whose task it is to make sure that research participants are protected from harm. You can ask me any more questions about any part of the research study, if you wish to . Do you have any questions?

PART II: *Certificate of Consent*

I have read the foregoing information or it has been read to me. I have been explained the procedure and complications. I am willing to participate in the study . I have had the opportunity to ask questions about it and any questions that I have asked have been answered to my satisfaction. I consent voluntarily to participant in this research.

Name of participant_____

Signature of participant_____

Date _____Day/Month/ Year

If illiterate a literate witness must sign (if possible, this person should be selected by the participant and should have no connection to the research team). Participants who are illiterate should include their thumb-prints as well.

I have a witnessed the accurate reading of the consent form to the potential participant and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Name of witness_____ Thumb print of participant

Signature of witness_____

Date_____

Statement by the researcher/person taking consent

I have accurately read out the information sheet to the potential participant and to the best of my ability made sure that the participation understands that the following will be done.

“EFFECTIVENESS OF CODUSE GROUP EXERCISE PROGRAM AND CONVENTIONAL PHYSIOTHERAPY EXERCISE IN IMPROVING BALANCE AND REDUCE RISK OF FALLS IN PATIENTS WITH MULTIPLE SCLEROSIS- A COMPARATIVE STUDY”

I confirm that the participant was given an opportunity to ask questions about the study and all the questions asked by the participant have been coerced into giving consent and the consent has been given freely and voluntarily.

A copy of this informed consent from has been provided to the participant.

Name of Research /person taking the consent_____

Signature of Researcher/person taking the consent_____

Date _____ Day/month/Year

APPENDIX-3

NEUROLOGICAL ASSESSMENT FORM

Name :

Age :

Sex :

Occupation :

Residential Address :

Chief complaints :

Past medical history :

Present medical history :

Personal history

Family history :

Associated problems :

Drug history :

Vital signs:

Temperature :

Blood pressure :

Heart rate :

Respiratory rate :

OBJECTIVE EXAMINATION

ON OBSERVATION

Body Built :

Posture :

Attitude of limbs :

Muscle wasting :

Pattern of movement :

Gait :

Pressure sore :

External Appliances :

Deformities :

PALPATION

Muscle tone :

Oedema :

Tenderness :

Warmth :

ON EXAMINATION

HIGHER MENTAL FUNCTIONS

LEVEL OF CONSCIOUSNESS :

ORIENTATION

Person :

Place :

Time :

MEMORY

Immediate :

Recent :

Remote :

ATTENTION

COMMUNICATION

EMOTIONAL STATUS

2. HIGHER CORTICAL FUNCTION:

COGNITION

Fund of knowledge :

Calculation :

Proverb interpretation :

PERCEPTION

Body scheme/body image disorder :

Agnosia :

Apraxia :

3. CRANIAL NERVES :

4. SENSORY SYSTEM :

Superficial sensation :

Deep sensation :

Cortical sensation :

5. MOTOR SYSTEM

Muscle girth

Muscle girth	Arm	Forearm	Thigh	Calf
Right				
Left				

Muscle tone

UPPER LIMB	LOWER LIMB

Range of motion

Upper limb

RT	Side	Shoulder						Elbow		Wrist	
		FLX	EXT	ABD	ADD	INT ROT	EXT ROT	FLX	EXT	FLX	EXT
LT											

REFLEXES

SUPERFICIAL

Abdominal :

Plantar :

Corneal :

DEEP

Biceps :

Triceps :

Brachioradialis :

Ankle jerk :

Knee jerk :

6. INVOLANTARY MOVEMENTS:

7. BALANCE

Balance	Static	Dynamic
Sitting		
Standing		

BBS SCORE:

TUG SCORE:

8 .GAIT

Step length :

Stride length :

Width of base :

Cadence :

9. ASSISTIVE DEVICES :

10. PHYSICAL THERAPY DIAGNOSIS:

Direct impairments :

Indirect impairments :

Composite impairments :

Functional limitations :

11. INVESTIGATION :

12. PHYSICAL THERAPY MANAGEMENT:

A)AIM

B)GOALS- SHORT TERM GOALS

LONG TERM GOALS

13. HOME PROGRAMME :

APPENDIX-4

ETHICAL CLEARANCE

Ethically permission for the study will be obtained from the subjects and a written consent will be taken from each subject who participates in this study, As this study involve human subjects the Ethical Clearance has been obtained from the Ethical committee of Nandha college of Physiotherapy, Erode as per the ethical guidelines for Bio-medical research on human subjects, 2000 ICMR,(Indian Council of Medical Research) New Delhi.

APPENDIX-5

Written Informed Consent Form

NANDHA COLLEGE OF PHYSIOTHERAPY, ERODE.

Informed consent form for the volunteers at “Nandha college of Physiotherapy, Erode”, who will be participating in the research project entitled : “ **CODUSE GROUP EXERCISE PROGRAM IMPROVES BALANCE REDUCE FALLS IN PEOPLE WITH MULTIPLE SCLEROSIS**”

Name of Principal Investigator	271720061 Poat graduate student
Name of Organization	Department of Physiotherapy, Nandha college of Physiotherapy, Erode

This Informed Consent Form has two parts:

- **Information Sheet (to share information about the research with you)**
- **Certificate of Consent (for signatures if you agree to take part)**

You will be given a copy of the full Informed Consent Form

PART I: Information Sheet

Introduction

I, _____ undergraduate student in the Department of Physiotherapy, Nandha college of Physiotherapy, Erode, am working on my dissertation titled : “ **CODUSE GROUP EXERCISE PROGRAM IMPROVES BALANCE REDUCE FALLS IN PEOPLE WITH MULTIPLE SCLEROSIS**”

I am going to give you information and invite you to be part of this research. You do not have to decide today whether or not you will participate in the research. Before you decide, you can talk to anyone you feel comfortable with about the research.

There may be some words that you do not understand. Please ask me to stop as we go through the information and I will take time to explain. If you have questions later, you can ask them and get yourself clarified.

Purpose of the research

To find out the effectiveness of CoDuSe group exercise program vs conventional physiotherapy exercises on balance and walking in multiple sclerosis patients.

Type of Research Intervention

In this study if you are selected, detailed history taking, clinical examination and routine investigations will be done.

Participant selection

Study group: Adult between age groups of 40-70 years presenting with history of MCA Stroke that occur following Contra lateral Hemiparesis (Worse in the arm and face than in the leg), Dysarthria, Hemianesthesia, Aphasia (if the dominant hemisphere is affected)

Voluntary Participation

Your participation in this research is entirely voluntary. It is your choice whether to participate or not. It will not affect our patient's treatment process.

Benefits

Personally you might be or may not be benefited in any way directly from the research. But by taking part in this research, you will be helping the scientific community.

Possible risks

There are no major physical risks for the person associated with these methods. Complications include exacerbation of symptoms after therapy which is rare possibility.

Reimbursements

You won't be given any monetary incentives or gifts for being a part of this research.

Confidentiality

The information that we collect from this research project will be kept confidential. Information about the patient that will be collected during the research will be put away and no-one but the researchers will be able to see it.

Right to Refuse or Withdraw

You do not have to take part in this research if you do not wish to do so. You may also stop participating in the research at any time you choose. It is your choice and all of your rights will still be respected.

Who to Contact

This proposal has been reviewed and approved by the Research and Ethical committee of Nandha college of physiotherapy, Erode, which is a committee whose task it is to make sure that research participants are protected from harm.

You can ask me any more questions about any part of the research study, if you wish to. Do you have any questions?

PART II: Certificate of Consent

I have read the foregoing information, or it has been read to me. I have been explained the procedure and complications. I am willing to participate in the study. I have had the opportunity to ask questions about it and any questions that I have asked have been answered to my satisfaction. I consent voluntarily to participate as a participant in this research.

Name of Participant _____

Signature of Participant _____

Date _____

Day/month/year

If illiterate a literate witness must sign (if possible, this person should be selected by the participant and should have no connection to the research team). Participants who are illiterate should include their thumb-print as well.

I have witnessed the accurate reading of the consent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Name of witness _____

Thumb print of participant

Signature of witness _____

Date _____

Master chart-1

APPENDIX-6

PRE AND POST TEST SCORES OF GROUP A AND GROUP B

SL. NO.	GROUP A(BBS)		GROUP B (BBS)	
	PRE TEST	POST TEST	PRE TEST	POST TEST
01	36	52	36	44
02	38	54	38	46
03	32	56	34	42
04	32	50	32	40
05	36	54	34	42
06	38	52	36	44
07	34	50	38	42
08	32	52	32	40
09	36	56	34	42
110	34	52	38	44
111	32	54	34	46
112	34	56	32	40
113	36	54	34	42
114	38	56	36	42
115	34	52	38	44

Master chart - 2

PRE AND POST TEST SCORES OF GROUP A AND GROUP B

SL. NO.	GROUP A(TUG)		GROUP B (TUG)	
	PRE TEST	POST TEST	PRE TEST	POST TEST
01	30	9	32	20
02	28	10	34	22
03	29	13	30	21
04	30	12	32	25
05	26	12	30	26
06	28	11	34	27
07	29	10	32	20
08	30	9	30	21
09	30	10	34	23
10	31	9	32	25
11	32	8	30	20
12	29	9	32	19
13	33	10	34	18
14	34	11	32	17
15	32	10	34	20

APPENIX-7

BERG BALANCE SCALE

SITTING TO STANDING

INSTRUCTIONS: The client is in sitting position, the client is asked to stand up and try not to use his hands.

- () 4 able to stand without using hands and stabilize independently
- () 3 able to stand independently using hands
- () 2 able to stand using hands after several tries
- () 1 needs minimal aid to stand or stabilize
- () 0 needs moderate or maximal assist to stand

2. STANDING UNSUPPORTED

INSTRUCTIONS: The client is asked to stand for two minutes without holding on.

- () 4 able to stand safely for 2 minutes
- () 3 able to stand 2 minutes with supervision
- () 2 able to stand 30 seconds unsupported
- () 1 needs several tries to stand 30 seconds unsupported
- () 0 unable to stand 30 seconds unsupported

If the client is able to stand 2 minutes unsupported, score full points for sitting unsupported. Proceed to item #4.

3. SITTING WITH BACK UNSUPPORTED BUT FEET SUPPORTED ON FLOOR OR ON A STOOL

INSTRUCTIONS: The client is asked to sit with arms folded for 2 minutes.

- () 4 able to sit safely and securely for 2 minutes
- () 3 able to sit 2 minutes under supervision
- () 2 able to able to sit 30 seconds

- () 1 able to sit 10 seconds
- () 0 unable to sit without support 10 seconds

4. STANDING TO SITTING

INSTRUCTIONS: The client is asked to sit down.

- () 4 sits safely with minimal use of hands
- () 3 controls descent by using hands
- () 2 uses back of legs against chair to control descent
- () 1 sits independently but has uncontrolled descent
- () 0 needs assist to sit

5. TRANSFERS

INSTRUCTIONS: Arrange chair(s) for pivot transfer. The client is asked to transfer one way toward a seat with armrests and one way toward a seat without armrests.

- () 4 able to transfer safely with minor use of hands
- () 3 able to transfer safely definite need of hands
- () 2 able to transfer with verbal cuing and/or supervision
- () 1 needs one person to assist
- () 0 needs two people to assist or supervise to be safe

6. STANDING UNSUPPORTED WITH EYES CLOSED

INSTRUCTIONS: The client is asked to close the eyes and stand still for 10 seconds.

- (6.1) 4 able to stand 10 seconds safely
- () 3 able to stand 10 seconds with supervision
- () 2 able to stand 3 seconds
- () 1 unable to keep eyes closed 3 seconds but stays safely
- () 0 needs help to keep from falling

7. STANDING UNSUPPORTED WITH FEET TOGETHER

INSTRUCTIONS: The client is asked to Place the feet together and stand without holding on.

- () 4 able to place feet together independently and stand 1 minute safely
- () 3 able to place feet together independently and stand 1 minute with supervision
- () 2 able to place feet together independently but unable to hold for 30 seconds
- () 1 needs help to attain position but able to stand 15 seconds feet together
- () 0 needs help to attain position and unable to hold for 15 seconds

8. REACHING FORWARD WITH OUTSTRETCHED ARM WHILE STANDING

INSTRUCTIONS: The client is asked to Lift arm to 90 degrees. Stretch out the fingers and reach forward as far as can. (Examiner places a ruler at the end of fingertips when arm is at 90 degrees. Fingers should not touch the ruler while reaching forward. The recorded measure is the distance forward that the fingers reach while the subject is in the most forward lean position. When possible, ask subject to use both arms when reaching to avoid rotation of the trunk.)

- () 4 can reach forward confidently 25 cm (10 inches)
- () 3 can reach forward 12 cm (5 inches)
- () 2 can reach forward 5 cm (2 inches)
- () 1 reaches forward but needs supervision
- () 0 loses balance while trying/requires external support

9. PICK UP OBJECT FROM THE FLOOR FROM A STANDING POSITION

INSTRUCTIONS: The client is asked to Pick up the shoe/slipper, which is place in front of the feet.

- () 4 able to pick up slipper safely and easily
- () 3 able to pick up slipper but needs supervision
- () 2 unable to pick up but reaches 2-5 cm(1-2 inches) from slipper and keeps balance independently
- () 1 unable to pick up and needs supervision while trying
- () 0 unable to try/needs assist to keep from losing balance or falling

10. TURNING TO LOOK BEHIND OVER LEFT AND RIGHT SHOULDERS WHILE STANDING

INSTRUCTIONS: The client is asked to Turn to look directly behind you over toward the left shoulder. Repeat to the right. Examiner may pick an object to look at directly behind the subject to encourage a better twist turn.

- () 4 looks behind from both sides and weight shifts well
- () 3 looks behind one side only other side shows less weight shift
- () 2 turns sideways only but maintains balance
- () 1 needs supervision when turning
- () 0 needs assist to keep from losing balance or falling

11. TURN 360 DEGREES

INSTRUCTIONS: The client is asked to Turn completely around in a full circle. Pause. Then turn a full circle in the other direction.

- () 4 able to turn 360 degrees safely in 4 seconds or less
- () 3 able to turn 360 degrees safely one side only 4 seconds or less
- () 2 able to turn 360 degrees safely but slowly
- () 1 needs close supervision or verbal cuing
- () 0 needs assistance while turning

12. PLACE ALTERNATE FOOT ON STEP OR STOOL WHILE STANDING UNSUPPORTED

INSTRUCTIONS: The client is asked to Place each foot alternately on the step/stool. Continue until each foot has touch the step/stool four times.

- () 4 able to stand independently and safely and complete 8 steps in 20 seconds
- () 3 able to stand independently and complete 8 steps in > 20 seconds
- () 2 able to complete 4 steps without aid with supervision
- () 1 able to complete > 2 steps needs minimal assist
- () 0 needs assistance to keep from falling/unable to try

13. STANDING UNSUPPORTED ONE FOOT IN FRONT

INSTRUCTIONS: (DEMONSTRATE TO SUBJECT) Place one foot directly in front of the other. If you feel that you cannot place your foot directly in front, try to step far enough ahead that the heel of your forward foot is ahead of the toes of the other foot. (To score 3 points, the length of the step should exceed the length of the other foot and the width of the stance should approximate the subject's normal stride width.)

- () 4 able to place foot tandem independently and hold 30 seconds
- () 3 able to place foot ahead independently and hold 30 seconds
- () 2 able to take small step independently and hold 30 seconds
- () 1 needs help to step but can hold 15 seconds
- () 0 loses balance while stepping or standing

14. STANDING ON ONE LEG

INSTRUCTIONS: The client is asked to Stand on one leg as long as you can without holding on.

- () 4 able to lift leg independently and hold > 10 seconds
- () 3 able to lift leg independently and hold 5-10 seconds
- () 2 able to lift leg independently and hold ≥ 3 seconds
- () 1 tries to lift leg unable to hold 3 seconds but remains standing independently.
- () 0 unable to try of needs assist to prevent fall
- () TOTAL SCORE (Maximum = 56)

TIME UP AND GO TEST

Method:

1. The patient starts in a seated position
2. The patient stands up upon therapist's command: walks 3 meters, turns around, walks back to the chair and sits down.
3. The time stops when the patient is seated.
4. The subject is allowed to use an assistive device. Be sure to document the assistive device used.
5. If a patient took 14 seconds or longer he or she was classified as high-risk for falling.

APPENDIX 8

Mc Donald criteria for MS

ATTACKS	LESIONS	ADDITIONAL CRITERIA FOR DIAGNOSIS MS
2 or more	2 or more	None. Clinical evidence alone will suffice
2 or more	1 lesion	Dissemination in space on MR (or await further clinical attack implicating a different CNS site)
1 attack	2 lesions	Dissemination in time on MR (or await further clinical attack implicating a different CNS site)
1 attack	1 lesion	Dissemination in space <i>and</i> time (or await further clinical attack implicating a different CNS site)
0 attack progression from onset		One year of disease progression (retrospective or prospective) AND at least 2 out of 3 criteria: <ul style="list-style-type: none"> • Dissemination in space in the brain • Dissemination in space in the spinal cord based on 2 or more T2 lesions • Positive CSF

APPENDIX-9

ABSTRACT

BACKGROUND:

Imbalance leading to falls is common in people with multiple sclerosis (PwMS).

OBJECTIVE:

To evaluate the effects of a balance group exercise programme (CoDuSe) on balance and walking in PwMS (Expanded Disability Status Scale, 4.0–7.5).

METHODS:

A multi-centre, randomized, controlled single-blinded pilot study with random allocation to early or late start of exercise, with the latter group serving as control group for the physical function measures. In total, 14 supervised 60-minute exercise sessions were delivered over 7 weeks. Pretest–posttest analyses were conducted for self-reported near falls and falls in the group starting late. Primary outcome was Berg Balance Scale (BBS). A total of 51 participants were initially enrolled; three were lost to follow-up.

RESULTS:

Post-intervention, the exercise group showed statistically significant improvement ($p = 0.015$) in BBS and borderline significant improvement in MS Walking Scale ($p = 0.051$), both with large effect sizes (3.66; -2.89). No other significant differences were found between groups. In the group starting late, numbers of falls and near falls were statistically significantly reduced after exercise compared to before ($p < 0.001$; $p < 0.004$).

CONCLUSION:

This pilot study suggests that the CoDuSe exercise improved balance and reduced perceived walking limitations, compared to no exercise. The intervention reduced falls and near falls frequency.